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THE POSITION OF BIRDS' FEET IN FLIGHT.¹

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THE FLIGHT of birds is generally so rapid that our impression as to the position of their feet is often a confused or conventional one, and not always correct, unless our attention has been particularly called to this point. This is shown, for example, in the taxidermist's soaring dove, whose feet are carefully drawn up in front, an erroneous position, as we shall see. In the case of many birds, however, it is not difficult on close observation to see clearly the feet, and to be sure of their position. In others, long study is necessary before the point is clear. The subject has interested me for some years, and I have accumulated a certain number of notes from my own observations and from literature, both of which are briefly summed up in the following paper. All studies of this sort are interesting in themselves, and may be of help in determining relationships.

Birds may be divided into two classes: I, those that habitually carry their feet stretched out behind during flight, and, II, those that carry them drawn up in front.

I. Birds that carry the feet behind.

As far as I know all water-birds habitually carry their feet behind in flight, but a few observations on the different orders may be of interest.

¹ Read at the Annual Meeting of the American Ornithologist Union, November 18, 1908.

PYGOPODES. As the Grebes are practically tail-less, their feet, extended to the rear, are very noticeable, while the feet of the Loon appear like a rudder behind their cutter-built bodies. In fact, it is very probable that the feet in these birds are used, like a long tail, as a rudder.

In the Auk family some have the feet brilliantly colored, so that they are noticeable, as is the case with the Puffin and Black Guillemot, where the feet are bright red. In the case of the Razor-billed Auk the tail is so long that the feet are concealed from above, while in the Murre, they extend slightly beyond the tail. Capt. G. E. H. Barrett-Hamilton (3), speaking of the Auks, says: "Here again the legs are still of considerable assistance to the flying bird, since they may be separated so as to increase the width of the tail; they may be placed both together at one side, or they may be allowed to partially drop and catch the wind with an effect possibly somewhat like that of the string of a kite."

LONGIPENNES. Although I have observed the backward position of the feet in numerous members of the Gull order, the most satisfactory bird to watch, and one with which I have had many opportunities, is the Herring Gull. These opportunities are greatest where the birds are protected and fearless, as is the case in the basin of the Charles River and in Boston Harbor. The legs are habitually extended behind under the tail, the feet generally close together but often apart. In quick turns, the feet are generally dropped pressed together, suggesting their use as a centerboard, for, as in a centerboard boat, quick turns with the board up are impossible, — with it down these turns become easy.

Several observers, namely Barrett-Hamilton (3), Meade-Waldo (15), and Anthony (1), mention the fact that Gulls of various species occasionally fly with one or both legs drawn up in front, more or less completely concealed in the feathers of the breast. Anthony infers that they do this to keep the feet warm, but I have seen this habit when the temperature was 40° Far., and Barrett-Hamilton (3) has observed it in mid-summer. I have observed this habit in the Glaucous and in the Great Black-backed Gull as well as in the Herring Gull. A Herring Gull I was watching had both feet held up in front, showing plainly against its white breast. While I was looking it drew down one foot and extended it behind in the usual manner, flying about in this way for several minutes. Another

bird, while sailing about with both feet behind, dropt them, shook them, and then inserted both in the feathers of the breast. Sometimes the feet carried forward show plainly, at other times they are buried all but the toes which appear as dark nobs, and again they are entirely concealed in the feathers of the breast, so that the bird appears to be destitute of feet. Birds with one foot concealed in front and one carried behind appear to have only one foot. I have noticed the habit both in the immature and in the adult Gulls.

I once saw a Common Tern bring one foot forward and scratch its head during flight — a surprising performance.

TUBINARES. I have never had the opportunity to observe the Albatross family but Barrett-Hamilton (4), in speaking of the flight of an Albatross with its feet stretched out backwards, says: "The legs are frequently moved as if to act as a rudder or to lessen the bird's pace — for example, when descending."

The Shearwaters usually skim so close to the water that their short feet are concealed, and I have not noted them during flight.

Of the Petrels, I have observed the feet extending beyond the tail in Wilson's Petrel, and have discovered that this is an excellent field mark to distinguish this species from Leach's Petrel, where the short feet are concealed below the tail, not even extending beyond the fork (19). This fact has also been noted by Riley (16).

STEGANOPODES. The Gannets, Cormorants, Pelicans, Tropic and Man-o'-War Birds all carry their feet behind. Many photographs by Chapman, Job and others show this point.

ANSERES. All the Ducks, Geese and Swans carry their feet behind, a point that is easily observed in some species. When they alight in the water, the feet are dropped and carried forward wide apart to break their fall. Meade-Waldo (15) states that he once saw a Mallard carry its feet in front during flight, just as has already been described in the case of the Gulls.

ODONTOGLOSSÆ. Chapman's photographs of Flamingos show the legs held behind in flight.

HERODIONES. The dexterity with which the Herons manage their ungainly legs, stretching them out behind in flight, is familiar to all. I once saw a Great Blue Heron attacked in mid-air from the rear by a screaming Tern. The Heron was so startled that it dropt for a moment its long legs, and stretched out and around its snake-like neck. That Storks, Ibises and Spoonbills carry

the legs behind has been affirmed by several observers, and the fact is shown in numerous published photographs.

PALUDICOLÆ. Our common Sora and Virginia Rails in flying short distances generally let their legs dangle straight down, but if the birds get well under way the legs are drawn up behind. The same is true of the American Coot or Fulica.

In the case of Cranes, I have had no experience, but Meade-Waldo (15) states that the legs are carried behind.

LIMICOLÆ. I have made numerous observations on many species of shore-birds, and all carry their legs behind in flight. This is most easily seen in the long-legged waders, but can be observed even in those with short legs.

Among the land birds both classes may be found but I shall continue with those that belong in Class I,—those that carry the feet behind.

GALLINÆ. The Pheasants, Grouse, Bob-whites, etc., all carry their feet behind when well under way, but, as it is probable that they all draw them up in front in starting, or flying only a few feet, their action has often been misunderstood. I have not been able to see the feet in the rapid flight of our Ruffed Grouse and Bob-white, but in the introduced Ring Pheasant, I once watched a flock of young birds in flight whose only partly grown tails did not conceal the long legs of the birds that extended backwards. Meade-Waldo (14) says that all game birds when launched on the wing carry their legs behind. Holdsworth (13) says: "The Pheasant and the Capercaille both rise with their feet in front, and when well on the wing turn them backwards." Hartert (11) states that all game birds carry the legs behind, and quotes Ogilvie Grant, Walter Rothschild and J. G. Millais in support of this assertion. Barrett-Hamilton (3) also confirms this.

COLUMBÆ. The familiar Pigeon of our streets, the descendant of the Rock Dove of Europe, affords an excellent opportunity for the study of the disposition of the feet during flight, yet I have found that even excellent observers are apt to see incorrectly until they have carefully studied the subject. The management of the feet is as in the Gallinæ. On rising from the ground, the Pigeon draws up its feet in front, but, as it gathers headway, the feet are drawn back and extended under the lower tail coverts. In this

position it soars or executes any flight of more than a few yards. When it flies but a short distance it does not have time, or it does not take the trouble, to draw up its feet behind, but carries them in front to be ready to drop them when it alights. In quick turns I have seen them drop their feet a short distance from the tail, so that daylight could be seen between, as has already been described in the case of the Gulls. One I was watching dropped its legs so that they hung straight down for a few seconds, and were then extended behind again. In alighting the feet are thrown forward, generally at the last moment.

RAPTORES. About the position of the feet in the Birds of Prey there has been from time to time considerable discussion, although the matter was apparently settled in the pages of 'The Ibis' in 1894 and 1895, when the Editor, after reviewing an article on the subject by Hartert (11), asked whether British ornithologists agreed with the author. Hartert (9) stated that he was convinced that all birds of prey carried their legs behind in flight, and the same habit had been recorded the year before by Ziemer (20). This observation was confirmed by Sclater (17), Barrett-Hamilton (2), Meade-Waldo (14) and Cordeaux (6), each having noted this habit in one or more species. Meade-Waldo had also observed it in trained Falcons. Hartert (12), in a later article on the subject, quoted E. C. Stuart Baker and Ogilvie Grant as sustaining him against the popular idea that the feet are carried in front. He also states that Kestrels when about to strike carry their legs forward and extended, and this is doubtless true of other Hawks. Barrett-Hamilton (3) says that while the normal position of the feet of Kites is backwards, still he "feels sure that Kites, like Gulls, can use either the backward or the forward position."

When the new U. S. twenty dollar gold piece appeared in 1907 with the design by St. Gaudens of an Eagle in flight, its legs behind, a protest went up. A writer in the Boston 'Transcript' said: "Whoever saw an eagle in flight with its legs trailing behind it like a heron?," thus voicing the popular idea that the legs are carried in front.

My own observations on this point in Birds of Prey are limited to the Osprey, Sparrow, Marsh, Rough-legged and Red-shouldered Hawks. At Bristol, R. I., the Ospreys are semi-domesticated,

for they build their nests on tall poles, erected for their convenience in barn-yards, and allow inspection at close range. Under these circumstances one can easily see that the legs are extended behind in flight,—and carried close under the tail. On one occasion I watched two Red-shouldered Hawks soaring together. In one the feet were stretched close under the tail, while the other had dropped them slightly, so that daylight was visible between the tail and the feet. A Sparrow Hawk that flew by me at Ipswich within 30 yards, showed the feet trailing behind, with a distinct gap between the tail and the legs, very much as in the St. Gaudens design.

The only observation I have made in the Owl family, was in the case of a Great Horned Owl that I watched flying about in one of Mr. John E. Thayer's large cages. In this case the legs were drawn to the rear and not forward, and the faster the bird flew the more the legs were extended behind. Meade-Waldo (15) states that the legs of Owls are carried behind, and Finley (7) has published an interesting photograph of a Barn Owl in full flight, where the legs are plainly extended behind. Mr. F. H. Kennard tells me that some Barred Owls that he kept always extended their feet behind in flight.

PSITTACI. Finn (8) has observed the feet carried behind in the Indian Parrot, *Palæornis torquatus*. Beebe (5) says of the Finsch Amazon Parrots in flight: "Each little foot clinched tightly close to the tail feathers."

COCYGES. Finn (8) by careful and long observations has determined that both Cuckoos and Kingfishers carry the feet behind. He observed birds in the wild state and also when confined in rooms for this purpose.

II. *Birds that carry the feet drawn up in front.*

In our review of the orders of North American birds, all have been considered but these, namely: Pici, Macrochires and Passeres.

PICI. The observations of Finn (8) are the only ones that I can find in this order. He has observed a Woodpecker carrying the feet in front in flight. I have often endeavored to determine this point in the Flicker, but have been as yet unable to do so.

MACROCHIRES. To determine the position of the feet during flight in the Goatsuckers, Swifts and Hummingbirds is a difficult problem, owing to the smallness of the feet and the habits of flight in this order, and I have no observations of my own to record. Finley has taken a photograph of a Hummingbird hovering about a flower in which the feet are in front. A photograph by Chapman (5¹) shows the same state of things. It is possible, however, that in full flight the feet may be extended behind. This order may therefore be put in the undetermined list.

PASSERES. The great order of perching birds alone remains, and it would seem natural that they should carry the feet in front as they fly from place to place, so as to be ready to seize their perch. As far as I know, this is the case. Barrett-Hamilton (3) gives a list of several passerine birds in whom he has observed the forward position of the feet, including the English Blackbird, Raven, Rook, and others of the Crow family. The Crow is our largest common Passerine bird, but its black color of plumage and feet makes it difficult to observe on the point in question. A Crow, in rising on the wing, often lets its feet hang at first, and then draws them up in front in an exceedingly leisurely manner. When well under way the feet are close against the breast, and are held there, I am inclined to believe, even in long flights, for I have several times observed Crows at Ipswich from a point in the dunes or beach where I could follow their flight for a long distance, and, as they passed me, their feet were always in front. I have notes of a Crow migrating along the beach one April day, flying slowly, and showing plainly the feet held in front, but dropped slightly so that daylight could be seen between them and the breast. This I have seen in other cases also. The feet are often held so close to the breast that only the clenched toes can be seen, while in other cases the feet seem to be entirely buried in the feathers. That excellent observer, Edmund Selous (18), gives a drawing of flying Ravens in which the feet are drawn up in front.

Other passerine birds, where I have been able to see the feet when the bird was in full flight, are: Red-winged Blackbird, Bronzed Grackle, English Sparrow, Eave, Tree and Barn Swallows, and Robin. In all of these the feet were carried in front.

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ORNITHOLOGICAL MISCELLANY FROM AUDUBON WARDENS.¹

BY B. S. BOWDISH.

IT IS my purpose to give here a few of the notes of interest gathered from letters and reports of wardens. Such notes are some of the incidental results of the warden system of the National Association of Audubon Societies.

BROWN PELICANS.—Brown Pelicans, on Pelican Island, Florida, started nesting nearly a month ahead of the usual time, or the first

¹ A paper presented to the American Ornithologists' Union, Cambridge, Mass. November 19, 1908.